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(54) Apparatus for storage and display of medical data

Gerät zur Speicherung und Darstellung medizinischer Daten

Appareil de stockage et affichage de données médicales

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EP-A- 0 338 812 **DE-A- 3 325 939**

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Description

The present invention relates generally to an image processing apparatus, and more particularly to a medical image processing apparatus for recording and reproducing a synthesis image formed by superimposing, on part of image data, attribute data which is associated with the image data.

This type of apparatus is widely used in the field of techniques relating to medical imaging or diagnosis. For example, in many cases, an angiogram obtained by a digital fluorography (DF) apparatus used as a diagnosing X-ray apparatus is displayed on a display device such as a TV monitor, and simultaneously a cardiogram spanning a time period from a predetermined time point to the time point of the display of the present angiogram is displayed. The view field of the X-ray fluoroscopic image is regularly circular, since the view field of the output optical image of an image intensifier tube is circular. Since the corners of the screen showing the angiogram are non-effective areas, the cardiogram may be superimposed anywhere in the corners without preventing the display of the angiogram. Thus, the synthesis image containing both the cardiogram (attribute data) and angiogram (image data) can be displayed. The angiogram obtained by the DF apparatus can be displayed in real time; however, the cardiogram cannot. The cardiogram indicates an output (cardio-potential) from an electrocardiograph over a time period between a time point at which the present angiogram is produced and a time point preceding this time point by several seconds. Thus, the output (attribute data) of the electrocardiograph is stored in a buffer memory, and a portion of the cardio-potential data corresponding to a time period associated with the angiogram obtained by the DF apparatus is read out from the buffer memory and superimposed on the angiogram. Thereby, a cardiogram is produced.

A conventional method of recording image data and attribute data relating to the above-described synthesis image will now be described. Image data from the DF apparatus are supplied to the display device and also to a recording device such as a digital VCR (video cassette recorder) and recorded successively on a video tape at every frame (more exactly, at every field). In this case, the output from the electrocardiograph has not yet been supplied to the VCR and is stored in the buffer memory. After a single diagnosing operation is completed and recording of all images is completed, all cardio-potential data associated with the single diagnosing operation are read out from the buffer memory and recorded, as a unit, next to the image data recording area of the tape. In the case of reproduction, similarly, all angiogram image data associated with the single diagnosing operation are reproduced and stored in the image memory. Thereafter, all cardio-potential data are reproduced and stored in the buffer memory. Then, the angiogram is read out from the image memory and the cardio-potential data, which span a time period from a time point at which the angiogram is produced to a time point preceding this time point by several seconds, are read out. The cardiogram formed on the basis of the read-out data is superimposed on a corner of the angiogram.

In the prior art described above, the image data and cardio-potential data are recorded at different places on a video tape at different time points. Thus, a time is wasted in recording the cardio-potential data, after the image data has been recorded. Despite the fact that both angiogram and cardio-potential data are simultaneously produced, these cannot be recorded simultaneously. In addition, in the case of reproduction, it is necessary to read out all angiogram data at first and then read out cardio-potential data, in order to form a synthesis image in which the cardiogram is superimposed on the angiogram. That is, the synthesis image cannot be reproduced and displayed immediately. All image data and all cardio-potential data must be reproduced even if only one synthesis image needs to be reproduced. Thus, the efficiency of the operation of the apparatus is not good.

DE-A- 33 25 939 discloses a medical image processing apparatus in form of a computer tomographic apparatus being equipped with an electrocardiogram sensor. The image data derived from the detected X-rays transmitted through the subject, and the output data of the electrocardiogram sensor are stored in a disc memory. For a reproduction, the data are read out from the disc memory and are displayed on a display screen showing the electrocardiogram and a cross-section of the heart corresponding to a chosen cardiac phase.

JP-A-61-217904 (abstract) is generally directed to a video signal recording and reproducing device. Separate information of data, except a video signal, are recorded in a horizontal scanning period which is invisible on a picture following a vertical retrace line period of the video signal. This signal is recorded on a video tape recorder. When reproducing the information, the additional data are separated and stored and may be used to replace, after video processing, the original video signal.

JP-A-1-319175 (abstract) discloses a picture recording and reproducing device wherein image data and identifying information are recorded on a recording medium. At the time of reproducing, two pieces of image data are stored in a frame memory and are processed by means of a subtraction technique in order to derive a digital subtraction angiography image.

EP-A- 0 338 812 discloses a magnetic tape recording/reproducing apparatus wherein, at a time of recording, a digital video signal is stored in one picture memory whereas digital sound signals are stored, at a different time, in another picture memory. The stored signals are stored at different times on the magnetic tape. During reproduction, the stored video and sound signals are read out from the magnetic tape.

The present invention has been made in consideration of the above circumstances, and its object is to provide a medical image processing apparatus capable

of recording, almost simultaneously, image data and attribute data associated with the image data and superimposed on the image data and displayed, both of which data are produced almost simultaneously, and capable of reproducing and displaying both data almost simultaneously in a reproducing mode, thereby reducing recording and reproducing time.

In order to achieve this object, there is provided a medical image processing apparatus comprising the features mentioned in Claim 1.

Some further details of the invention are mentioned in the subclaims.

According to the image processing apparatus of this invention, one unit of image data and associated attribute data which are synthesized and displayed by the display means are recorded on one unit of image recording area of the recording medium. Thus, the image and the attribute data which are produced almost simultaneously can be recorded almost simultaneously. In the reproducing mode, too, both data can be reproduced and displayed almost simultaneously, thereby reducing the recording and reproducing time.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a block diagram showing an image processing apparatus according to an embodiment of the present invention;

Fig. 2 shows an example of a cardiogram obtained in the embodiment;

Fig. 3 shows an example of a display synthesis image in the embodiment;

Fig. 4 shows an example of a signal format recorded in a digital VCR serving as a recording device in the embodiment; and

Fig. 5 shows another example of the signal format recorded in the digital VCR serving as recording device in the embodiment.

An embodiment of the image processing apparatus of the present invention will now be described with reference to the accompanying drawings. Fig. 1 is a block diagram showing a structure of the embodiment of the invention as applied to a DF apparatus. A bed 11 is provided on a DF apparatus body (not shown). An X-ray tube 12 is situated below the bed 11. The X-ray tube 12 emits X-rays to a subject 10 on the bed 11. The X-rays, which have passed through the subject 10, are input to an image intensifier tube 14 provided above the bed 11 and the input X-rays are converted to an optical image representing the X-ray transmittance image of the subject 10. The optical image output from the image intensifier tube 14 is input to a monochromatic TV camera 18 through an optical system 16. The view field of the optical image output from the image intensifier tube 14 is circular. The output from the TV camera 18 is supplied to an image processing device 20. On the basis of the optical image, the TV camera 18 produces an X-ray image of the subject 10. The subject 10 is connected to an electrocardiograph 22 for detecting a cardio-potential. The output from the electrocardiograph 22 is also supplied to the image processing device 20 as an attribute data of the X-ray image. The TV camera 18 may comprise an image-pickup tube or a solid state image-pickup device such as a charge-coupled device (CCD).

The X-ray image data output from the TV camera 18 is fed to an image memory 26 through an A/D converter 24 and is stored therein temporarily. The TV camera 18 outputs interlaced frame images at a rate of 30 frames per second (i.e. 60 field images per second). The image memory 26 has such a capacity as to store X-ray image data of several frames. The image data in the image memory 26 is fed to an image processor 28 and subjected to various image processing. The processed image data are stored in the image memory 26 in an updating manner. The image processor 28 calculates a subtraction image between two continuous frame images. Thus, on the basis of the subtraction between the two images obtained before and after a contrast medium reaches the artery of a region-of-interest (ROI) of the subject 10 after the medium is injected in the vein, a high-contrast angiogram image from which an image of the regions other than the blood vessel has been removed can be obtained. In addition, the image processor 28 reduces noise by means of a recursive filter, emphasizes an edge by means of a spatial filter, and carries out window processing for adjusting a display gray level. The image data in the image memory 26 subjected to such image processing is fed to a synthesizing circuit 30.

A cardio-potential data output from the electrocardiograph 22 is supplied to a cardiograph memory 34 through an A/D converter 32, and is temporarily stored in the memory 34. The cardio-potential data is output at a cycle of, for example, 240 Hz. The cardiograph memory 34 has such a capacity as to store the data output from the electrocardiograph 22 over several seconds (about 2 to 3 seconds) which is necessary for producing a cardiogram. The output from the cardiograph memory 34 is input to the synthesizing circuit 30. The synthesizing circuit 30 has a first frame memory for producing a cardiogram from the cardio-potential data and a second frame memory for synthesizing the angiogram and the cardiogram and displaying a synthesis image. As is shown in Fig. 2, coordinates (ordinate = cardio-potential level v: abscissa = time t) is imaginarily set in the first frame memory. The output data from the cardiograph memory 34 is plotted in the coordinates. In order to connect all plotted data, a vertical bar is drawn from each plotted point to the level of the next point. Thus, a cardiogram is produced. In this case, it is supposed that the output cycle of the electrocardiograph is equal to the horizontal resolution of a display. Thus, the vertical bars are drawn. If the horizontal resolution is higher than the output cycle of the electrocardiograph, the cardiogram

may be produced by drawing vertical bars after interpolating data along the time axis, or plotting only the points after interpolating data along the time axis in units of resolution. As is shown in Fig. 3, the second frame memory for display of the synthesizing circuit 30 stores data relating to a cardiogram 52 and a angiogram 50. The angiogram 50 of a circular view field is displayed at the center of the display screen and the cardiogram 52 is displayed at a non-effective area of the screen, i.e. a corner of the screen. The output (data of the second frame memory) of the synthesizing circuit 30 is supplied to a display device (TV monitor) 38 via a D/A converter 36.

On the other hand, the image memory 26 and cardiograph memory 34 are connected to a digital VCR 44 via a recording/reproducing processor 40 and an interface 42. The recording/reproducing processor 40 superimposes cardio-potential data (attribute data) on a portion of the output data (image data) of the image memory 26, which is other than the effective image area, thereby recording, on a single image recording area (one field image area, in this case) of a video tape, both image data and attribute data relating to the synthesis image displayed on the TV monitor 38. Specifically, the effective image area of the angiogram is only within the circular view field, and the cardio-potential data can be superimposed on the region other than the effective image area of the angiogram. As is shown in Fig. 4, the effective image area of each line image data is only its center portion; thus, even if cardio-potential data is recorded at the peripheral portion of the line image data, the angiogram cannot be adversely affected. The portions of the effective image areas of the respective line image data vary from one another. Thus, the time periods in which cardio-potential data can be superimposed on each line image data differ from one another. If the control of superimposing is troublesome or the non-effective image area is smaller than the cardio-potential data, it is possible that the image data is compressed and the capacity of a single image data is made smaller than a single image recording area of the recording medium and the cardio-potential data is stored in the remaining portion. For example, as shown in Fig. 5, it is possible that the compressed image data of one field is assigned to the latter part of each field period (16.6 ms) and the cardio-potential data is assigned to the former part of the field period. Though not shown, the order of recording the cardio-potential data and the image data may be reversed, and one cardiogram data may be assigned to one of two fields forming a frame.

In the case of reproduction, a data read out from the VCR 44 is similarly divided into an image data and a cardio-potential data in the recording/reproducing processor 40, and the divided components are supplied to the image memory 26 and the cardiograph memory 34, respectively. When the image data is data-compressed and stored, the reproduced image data is data-expanded and fed to the image memory 26. Thus, in the reproducing mode, each field image is stored in the image memory 26 and cardio-potential data corresponding to the cardiogram assigned to the field image is stored in the cardiograph memory 34.

The operation of the embodiment having the above structure will now be described. A contrast medium is injected to the vein of the subject 10, and X-rays are radiated on the subject 10. Each frame X-ray fluoroscopic image data output from the TV camera 18 is successively written in the image memory 26 via the A/D converter 24. Simultaneously, the output from the cardiograph 22 indicating the cardio-potential of the subject 10 is successively written in the cardiograph memory 34 through the A/D converter 32. Each frame image data in the image memory 26 and the image data of the next frame are subjected to a subtraction processing. Thus, on the basis of frame images obtained before and after the contrast medium reaches the artery of the region-of-interest (ROI), an angiogram from which the image other than the image of the blood vessel has been removed can be obtained. The angiogram of each frame is supplied to the synthesizing circuit 30. The synthesizing circuit 30 reads out, from the cardiograph memory 34, the cardio-potential data obtained until about two seconds before the time point corresponding to the angiogram frame. Based on the read-out data, the cardiogram waveform as shown in Fig. 2 is superimposed on the area other than the circular effective image area of the angiogram, and the resultant image is displayed on the TV monitor 38.

On the other hand, the data relating to the angiogram and cardiogram displayed on the TV monitor 38 is supplied from the image memory 26 and cardiograph memory 34 to the recording/reproducing processor 40. As has been described above, the recording/reproducing processor 40 functions, as shown in Figs. 4 and 5, to record the synthesis image data formed of the angiogram and cardiogram and displayed on the TV monitor 38 on the image recording area of a single field of the video tape. Thus, it is possible to simultaneously record the angiogram and cardiogram data on the VCR 44 which are simultaneously displayed.

In the reproducing mode, similarly, the recording/reproducing processor 40 divides the data read out from the VCR 44 into the image data and cardio-potential data at every field. The image data and cardio-potential data are written in the image memory 26 and the cardiogram memory 34, respectively. Thus, only by reproducing the data on the image recording area of one field of the video tape, the data relating to the angiogram and the corresponding cardiogram can simultaneously be reproduced and a synthesis image in which the cardiogram is superimposed on the angiogram can be immediately displayed.

As has been described above, according to the present invention, there is provided an image processing apparatus wherein the synthesis image formed of the image data and the related attribute data displayed

by the display means is recorded on a single image recording area of a recording medium. Thus, the image data and attribute data, both of which are produced almost simultaneously, can be recorded almost in real time. In the reproducing mode, too, both data can be reproduced and displayed almost simultaneously and the recording/reproducing time can be shortened. The recording format for the image data and attribute data may be a format wherein attribute data is assigned to a non-effective data area of image data, or a format wherein image data is compressed and both the compressed image data and attribute data are assigned to the image recording areas of each field or frame of the recording medium. Unlike in the prior art, the time taken for recording attribute data after image data have been recorded can be saved, and therefore the recording time can be reduced. In addition, in the reproducing mode, unlike in the prior art, it is not necessary to read all image data in advance. Only by reproducing a data of a desired one frame, the image and related attribute data can be reproduced, as a synthesis image, simultaneously and immediately. Thereby, the through-put can be increased and the operator's work load can be reduced.

Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the present invention in its broader aspects is not limited to the specific details, representative devices, and illustrated examples shown and described herein. Accordingly, various modifications may be made without departing from the scope of the general inventive concept as defined by the appended claims. The cardiogram data may not be displayed as a waveform, and it may be displayed as a table or simple numerical values. In the above description, the image data is an angiogram obtained from an X-ray fluoroscopic image; however, the image data is not limited to this. In the case of the X-ray fluoroscopic image, this image is not limited to a angiogram obtained after image processing such as subtraction processing or filtering, and may be an X-ray fluoroscopic image before the processing. In the above embodiment, since the TV camera picks up images in an interlace system, the image data is compressed such that cardio-potential data is assigned prior to compressed image data at each field image; however, in the case of a non-interlace system, the image data and attribute data may be recorded at each frame. In addition, the attribute data may not be recorded before and after the compressed image data; the attribute data may be assigned within the image data. In the above embodiment, reproduced data is supplied to the synthesizing circuit 30 after it was once stored in the image memory 26 and cardiograph memory 34; however, it may be supplied directly to the synthesizing circuit 30.

Claims

1. A medical image processing apparatus for displaying an image from image data and cardiogram data of a subject, and recording the image and cardiogram data on an image recording medium in a VCR (44), said apparatus comprising:

   said VCR (44);
   X-ray fluorographic means (12, 14, 18) for radiating X-rays on said subject, and picking up an X-ray image of the subject, thereby obtaining fluoroscopic X-ray motion picture data which include plural X-ray images as said image data;
   storage means (34) for storing raw data of said cardiogram data;
   recording means (40) for recording the fluoroscopic X-ray image data and said raw data of said cardiogram data in predetermined recording areas of said image recording medium, each said predetermined recording area storing the data for one frame of said X-ray image and raw data of said cardiogram having a length of at least two seconds;
   reproducing means (40) for reproducing data from a said predetermined recording area, separating the reproduced data into said fluoroscopic X-ray image data and said raw data of said cardiogram data;
   synthesizing means (30) for superimposing said fluoroscopic X-ray image data and said raw data of said cardiogram data into data of a synthesis image, said synthesis image being formed of a main image, derived from said fluoroscopic X-ray image data, and a secondary image, separate from the main image and derived from the stored cardiogram data; and
   display means (38) coupled to said synthesizing means for displaying said synthesis image.

2. The apparatus according to claim 1, characterized in that said VCR (44) recording means (40) records said cardiogram data on a portion of said predetermined recording area which is not occupied by effective data of said image data, wherein said effective data correspond to a field of view of said image pick-up device used for picking up said image data.

3. The apparatus according to claim 1, characterized in that said recording means (40) includes data compression means and records said image data on said predetermined recording area after compressing the amount of said image data, and said reproducing means (40) includes data expansion means and supplies reproduced image data to said display means (38) after expanding the amount of the reproduced image data.

4. The apparatus according to claim 3, characterized in that said recording means (40) records the com-

pressed image data following the cardiogram data in said predetermined image recording area.

5. The apparatus according to claim 3, characterized in that said recording means (40) records said cardiogram data following the compressed image data in said predetermined image recording area.

6. The apparatus according to claim 1, characterized by further comprising means (30, 34) for producing data corresponding to a graph from said cardiogram data and for causing superimposing of said graph on a portion of said image in said synthesis image.

7. The apparatus according to claim 1, characterized in that said VCR (44) is a digital VCR (44).

8. The apparatus according to claim 1, further comprising a detecting means (22) which is an electrocardiograph, said main and secondary images displayed by said display means (38) being an angiogram and a cardiogram, respectively.

9. The apparatus according to claim 1, further comprising means (26, 28) for obtaining an angiogram, from said fluoroscopic X-ray image data obtained after injecting a contrast medium into a blood vessel of said object, wherein said angiogram is obtained by subtraction of the fluoroscopic X-ray image data from two images in a sequence.

10. The apparatus according to claim 1, further characterized in that

said X-ray fluorographic means includes an image intensifier tube (14) for converting said X-ray image which has passed through said object into said optical image, said optical image output from said image intensifier tube having a circular field of view, so that said effective image area of said main image in said synthesis image is also circular;
said synthesizing means (30) causes said display means (38) to display said synthesis image with said secondary image outside said circular effective image area of said main image;
said recording means (40) records said cardiogram data on a portion of said predetermined recording area which is not occupied by image data representing said circular effective image area of said main image.

11. The apparatus according to claim 1, characterized in that said recording means (40) includes data compression means and records said fluoroscopic X-ray image data in one part of said predetermined recording area after compressing the amount of said fluoroscopic X-ray image data, and records said cardiogram data in the other part of said predetermined image recording area.

12. The apparatus according to claim 11, characterized in that said recording means (40) records the compressed fluoroscopic X-ray image data following said cardiogram data in said predetermined image recording area.

13. The apparatus according to claim 11, characterized in that said recording means (40) records said cardiogram data following the compressed fluoroscopic X-ray image data in said predetermined image recording area.

Patentansprüche

1. Medizinisches Bildverarbeitungsgerät zur Anzeige eines Bilds auf der Grundlage von Bilddaten und Kardiogrammdaten eines Objekts, und zur Aufzeichnung der Bild- und Kardiogrammdaten auf einem Bildaufzeichnungsmedium in einem Videokassettenrekorder (44), wobei das Gerät aufweist:

den Videokassettenrekorder (44),
eine fluorographische Röntgenstrahleinrichtung (12, 14, 18) zum Aussenden von Röntgenstrahlen zu dem Objekt und zum Aufnehmen eines Röntgenbilds, wobei hierdurch fluoroskopische Röntgenstrahl-Bewegungsbilddaten erzielt werden, die die Bilddaten bilden und eine Mehrzahl von Röntgenbildern enthalten,
eine Speichereinrichtung (34) zum Speichern von Rohdaten der Kardiogrammdaten,
eine Aufzeichnungseinrichtung (40) zum Aufzeichnen der fluoroskopischen Röntgenbilddaten und der Rohdaten der Kardiogrammdaten in vorbestimmten Aufzeichnungsbereichen des Bildaufzeichnungsmediums, wobei in jedem vorbestimmten Aufzeichnungsbereich die Daten für ein Bild oder Teilbild des Röntgenbilds und Rohdaten des Kardiogramms mit einer Länge von mindestens zwei Sekunden gespeichert sind,
eine Reproduktionseinrichtung (40) zum Reproduzieren von Daten aus einem vorbestimmten Aufzeichnungsbereich zum Separieren der reproduzierten Daten in die fluoroskopischen Röntgenbilddaten und die Rohdaten der Kardiogrammdaten,
eine Synthetisiereinrichtung (30) zum Überlagern der fluoroskopischen Röntgenbilddaten und der Rohdaten der Kardiogrammdaten zu Daten eines synthetisierten Bilds, wobei das synthetisierte Bild durch ein Hauptbild, das aus den fluoroskopischen Röntgenbilddaten gewonnen wird, und ein sekundäres Bild gebildet

ist, das von dem Hauptbild getrennt ist und aus den gespeicherten Kardiogrammdaten erhalten worden ist, und
eine Anzeigeeinrichtung (38), die mit der Synthetisiereinrichtung gekoppelt ist und zur Anzeige des synthetisierten Bilds dient.

2. Gerät nach Anspruch 1, dadurch **gekennzeichnet**, daß die Aufzeichnungseinrichtung (40) die Kardiogrammdaten in einem Abschnitt des vorbestimmten Aufzeichnungsbereichs, der nicht durch effektive Daten der Bilddaten belegt ist, aufzeichnet, wobei die effektiven Daten einem Gesichtsfeld der Bildaufnehmereinrichtung entsprechen, die zum Aufnehmen der Bilddaten eingesetzt wird.

3. Gerät nach Anspruch 1, dadurch **gekennzeichnet**, daß die Aufzeichnungseinrichtung (40) eine Datenkomprimierungseinrichtung enthält und die Bilddaten in dem vorbestimmten Aufzeichnungsbereich nach dem Komprimieren der Bilddatenmenge aufzeichnet, und daß die Reproduktionseinrichtung (40) eine Datenexpandiereinrichtung enthält und reproduzierte Bilddaten an die Anzeigeeinrichtung (38) nach dem Expandieren der reproduzierten Bilddatenmenge anlegt.

4. Gerät nach Anspruch 3, dadurch **gekennzeichnet**, daß die Aufzeichnungseinrichtung (40) die komprimierten Bilddaten im Anschluß an die Kardiogrammdaten in dem vorbestimmten Bildaufzeichnungsbereich aufzeichnet.

5. Gerät nach Anspruch 3, dadurch **gekennzeichnet**, daß die Aufzeichnungseinrichtung (40) die Kardiogrammdaten im Anschluß an die komprimierten Bilddaten in dem vorbestimmten Bildaufzeichnungsbereich aufzeichnet.

6. Gerät nach Anspruch 1, dadurch **gekennzeichnet**, daß es weiterhin eine Einrichtung (30, 34) zum Produzieren von einer graphischen Darstellung entsprechenden Daten aus den Kardiogrammdaten und zum Veranlassen einer Überlagerung der graphischen Darstellung auf einem Teil des Bilds in dem synthetisierten Bild enthält.

7. Gerät nach Anspruch 1, dadurch **gekennzeichnet**, daß der Videokassettenrekorder (44) ein digitaler Videokassettenrekorder (44) ist.

8. Gerät nach Anspruch 1, das weiterhin eine Erfassungseinrichtung (22) aufweist, die durch einen Elektrokardiograph gebildet ist, wobei das Hauptbild und das sekundäre Bild, die durch die Anzeigeeinrichtung (38) angezeigt werden, ein Angiogramm bzw. ein Kardiogramm sind.

9. Gerät nach Anspruch 1, das weiterhin eine Einrichtung (26, 28) zum Erzeugen eines Angiogramms auf der Grundlage der fluoroskopischen Röntgenbilddaten enthält, die nach dem Injizieren eines Kontrastmittels in ein Blutgefäß des Objekts erhalten wurden, wobei das Angiogramm dadurch gebildet wird, daß die fluoroskopischen Röntgenbilddaten von zwei Bildern in einer Folge subtrahiert werden.

10. Gerät nach Anspruch 1, dadurch **gekennzeichnet**,

daß die fluorographische Röntgenstrahleinrichtung eine Bildverstärkerröhre (14) zum Umwandeln des Röntgenbilds, das durch das Objekt hindurchgetreten ist, in das optische Bild enthält, wobei das optische Bild, das von der Bildverstärkerröhre abgegeben wird, ein kreisförmiges Gesichtsfeld aufweist, so daß der effektive Bildbereich des Hauptbilds in dem synthetisierten Bild ebenfalls kreisförmig ist,
daß die Synthetisiereinrichtung (30) die Anzeigeeinrichtung (38) dazu veranlaßt, das synthetisierte Bild so anzuzeigen, daß das sekundäre Bild außerhalb des kreisförmigen effektiven Bildbereichs des Hauptbilds liegt, und
daß die Aufzeichnungseinrichtung (40) die Kardiogrammdaten in einem Abschnitt des vorbestimmten Aufzeichnungsbereichs aufzeichnet, der nicht durch Bilddaten belegt ist, die den kreisförmigen effektiven Bildbereich des Hauptbilds repräsentieren.

11. Gerät nach Anspruch 1, dadurch **gekennzeichnet**, daß die Aufzeichnungseinrichtung (40) eine Datenkomprimierungseinrichtung enthält und die fluoroskopischen Röntgenbilddaten in einem Teil des vorbestimmten Aufzeichnungsbereichs nach dem Komprimieren der Menge von fluoroskopischen Röntgenbilddaten aufzeichnet, und die Kardiogrammdaten in dem anderen Teil des vorbestimmten Bildaufzeichnungsbereichs aufzeichnet.

12. Gerät nach Anspruch 11, dadurch **gekennzeichnet**, daß die Aufzeichnungseinrichtung (40) die komprimierten fluoroskopischen Röntgenbilddaten im Anschluß an die Kardiogrammdaten in dem vorbestimmten Bildaufzeichnungsbereich aufzeichnet.

13. Gerät nach Anspruch 11, dadurch **gekennzeichnet**, daß die Aufzeichnungseinrichtung (40) die Kardiogrammdaten im Anschluß an die komprimierten fluoroskopischen Röntgenbilddaten in dem vorbestimmten Bildaufzeichnungsbereich aufzeichnet.

Revendications

1. Appareil de traitement d'image médical pour afficher une image à partir de données d'images et de données de cardiogramme d'un sujet, et pour enregistrer l'image et les données de cardiogramme sur un support d'enregistrement d'images dans un magnétoscope (44), ledit appareil comprenant :

   - ledit magnétoscope (44) ;
   - des moyens fluorographiques à rayons X (12, 14, 18) pour irradier des rayons X sur ledit sujet, et pour prendre une image aux rayons X du sujet, en obtenant ainsi des données d'images en mouvement par fluoroscopie aux rayons X qui incluent une pluralité d'images aux rayons X formant lesdites données d'images ;
   - des moyens de stockage (34) pour stocker des données brutes desdites données de cardiogramme ;
   - des moyens d'enregistrement (40) pour enregistrer les données d'images par fluoroscopie aux rayons X et lesdites données brutes desdites données de cardiogramme dans des zones d'enregistrement prédéterminées dudit support d'enregistrement d'images, chacune desdites zones d'enregistrement prédéterminées stockant les données pour une prise de ladite image aux rayons X, et les données brutes dudit cardiogramme ayant une longueur d'au moins deux secondes ;
   - des moyens de reproduction (40) pour reproduire des données depuis une zone d'enregistrement prédéterminée, pour séparer les données reproduites et former lesdites données d'images par fluoroscopie aux rayons X et lesdites données brutes desdites données de cardiogramme ;
   - des moyens de synthétisation (30) pour superposer lesdites données d'images par fluoroscopie aux rayons X et lesdites données brutes desdites données de cardiogramme en formant des données d'une image de synthèse, ladite image de synthèse étant formée d'une image principale, dérivée desdites données d'images par fluoroscopie aux rayons X et d'une image secondaire, séparée de l'image principale et dérivée des données de cardiogramme stockées ; et
   - des moyens d'affichage (38) accouplés auxdits moyens de synthétisation pour afficher ladite image de synthèse.

2. Appareil selon la revendication 1, caractérisé en ce que lesdits moyens d'enregistrement (40) enregistrent lesdites données de cardiogramme sur une partie de ladite zone d'enregistrement prédéterminée qui n'est pas occupée par des données effectives desdites données d'images, dans lesquelles lesdites données effectives correspondent à un champ de vue dudit dispositif de saisie d'images utilisé pour saisir lesdites données d'images.

3. Appareil selon la revendication 1, caractérisé en ce que lesdits moyens d'enregistrement (40) incluent des moyens de compression de données, et enregistrent lesdites données d'images sur ladite zone d'enregistrement prédéterminée après compression de la quantité desdites données d'images, et en ce que lesdits moyens de reproduction (40) incluent des moyens d'expansion de données et fournissent des données d'images reproduites auxdits moyens d'affichage (38) après expansion de la quantité des données d'images reproduites.

4. Appareil selon la revendication 3, caractérisé en ce que lesdits moyens d'enregistrement (41) enregistrent les données d'images comprimées à la suite des données de cardiogramme dans ladite zone d'enregistrement d'images prédéterminée.

5. Appareil selon la revendication 3, caractérisé en ce que lesdits moyens d'enregistrement (40) enregistrent lesdites données de cardiogramme à la suite des données d'images comprimées dans ladite zone d'enregistrement d'images prédéterminée.

6. Appareil selon la revendication 1, caractérisé en ce qu'il comprend en outre des moyens (30, 34) pour produire des données correspondant à un graphique à partir desdites données de cardiogramme et pour produire une superposition dudit graphique sur une partie de ladite image dans ladite image de synthèse.

7. Appareil selon la revendication 1, caractérisé en ce que ledit magnétoscope (44) est un magnétoscope numérique (44).

8. Appareil selon la revendication 1, comprenant en outre des moyens de détection (22) qui sont un électro-cardiographe, ladite image principale et ladite image secondaire affichées par lesdits moyens d'affichage (38) étant respectivement un angiogramme et un cardiogramme.

9. Appareil selon la revendication 1, comprenant en outre des moyens (26, 28) pour obtenir un angiogramme depuis lesdites données d'images par fluoroscopie aux rayons X obtenues après avoir injecté un agent de contraste dans un vaisseau sanguin dudit sujet, dans lequel ledit angiogramme est obtenu par soustraction des données d'images par fluoroscopie aux rayons X depuis deux images dans une séquence.

10. Appareil selon la revendication 1, caractérisé en outre en ce que :

- lesdits moyens fluorographiques aux rayons X incluent un tube d'amplification d'images (14) pour convertir ladite image aux rayons X qui a traversé ledit sujet pour former ladite image optique, ladite image optique délivrée par ledit tube d'amplification d'images ayant un champ de vue circulaire, de sorte que ladite zone d'image effective de ladite image principale dans ladite image de synthèse est également circulaire ;
- lesdits moyens de synthétisation (30) amenant lesdits moyens d'affichage (38) à afficher ladite image de synthèse avec ladite image secondaire à l'extérieur de ladite zone d'image effective circulaire de ladite image principale ; et
- lesdits moyens d'enregistrement (40) enregistrent lesdites données de cardiogramme sur une partie de ladite zone d'enregistrement prédéterminée qui n'est pas occupée par des données d'images représentant ladite zone d'image effective circulaire de ladite image principale.

11. Appareil selon la revendication 1, caractérisé en ce que lesdits moyens d'enregistrement (40) incluent des moyens de compression de données et enregistrent lesdites données d'images par fluoroscopie aux rayons X dans une partie de ladite zone d'enregistrement prédéterminée après compression de la quantité desdites données d'images par fluoroscopie aux rayons X, et enregistrent lesdites données de cardiogramme dans l'autre partie de ladite zone d'enregistrement d'images prédéterminée.

12. Appareil selon la revendication 11, caractérisé en ce que lesdits moyens d'enregistrement (40) enregistrent les données d'images par fluoroscopie aux rayons X comprimées à la suite desdites données de cardiogramme dans ladite zone d'enregistrement d'images prédéterminée.

13. Appareil selon la revendication 11, caractérisé en ce que lesdits moyens d'enregistrement (40) enregistrent lesdites données de cardiogramme à la suite des données d'images par fluoroscopie aux rayons X comprimées dans ladite zone d'enregistrement d'images prédéterminée.

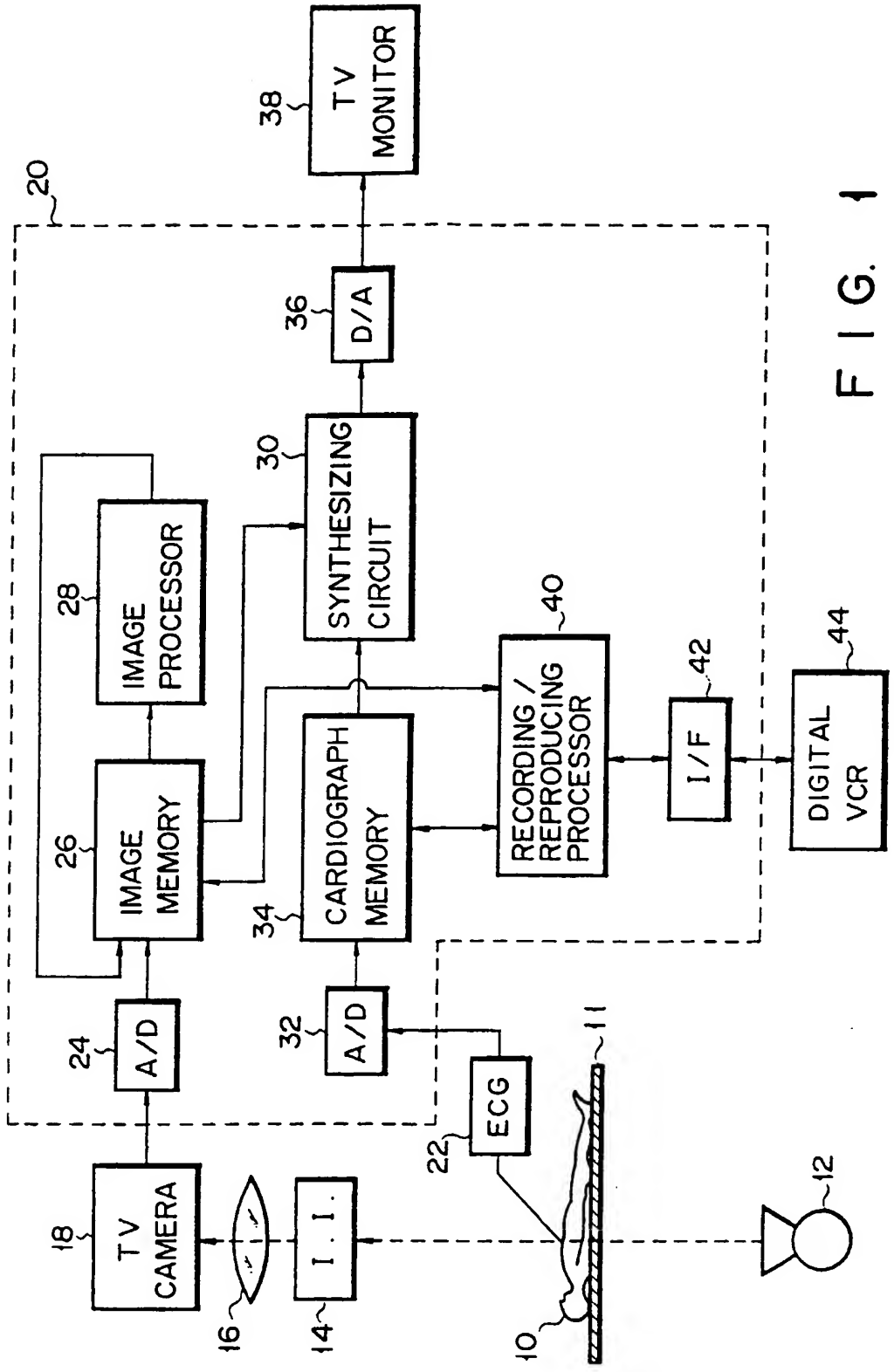
TV MONITOR
38
20
D/A
36
SYNTHESIZING CIRCUIT
30
IMAGE PROCESSOR
28
IMAGE MEMORY
26
CARDIOGRAPH MEMORY
34
RECORDING / REPRODUCING PROCESSOR
40
I/F
42
DIGITAL VCR
44
A/D
24
A/D
32
ECG
22
TV CAMERA
18
I.I.
14
16
10
11
12

FIG. 1

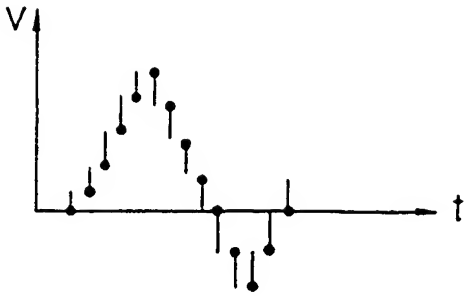

FIG. 2

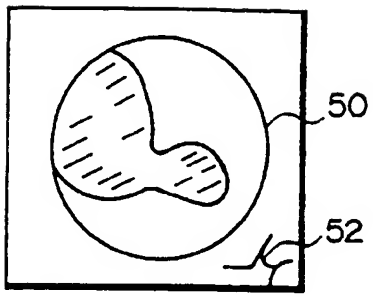

FIG. 3

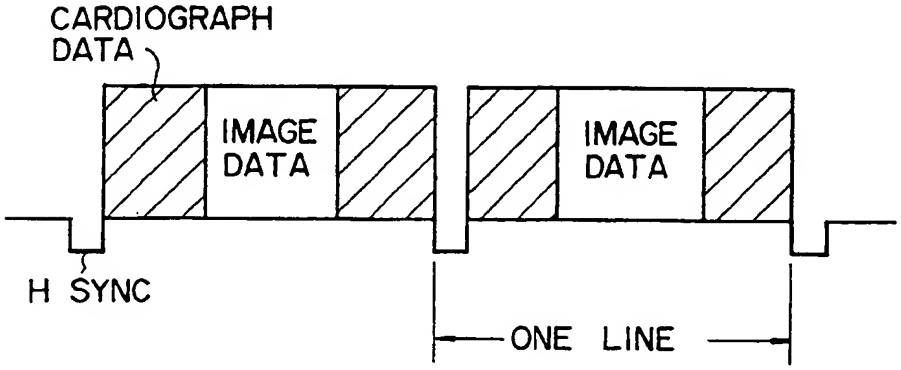

FIG. 4

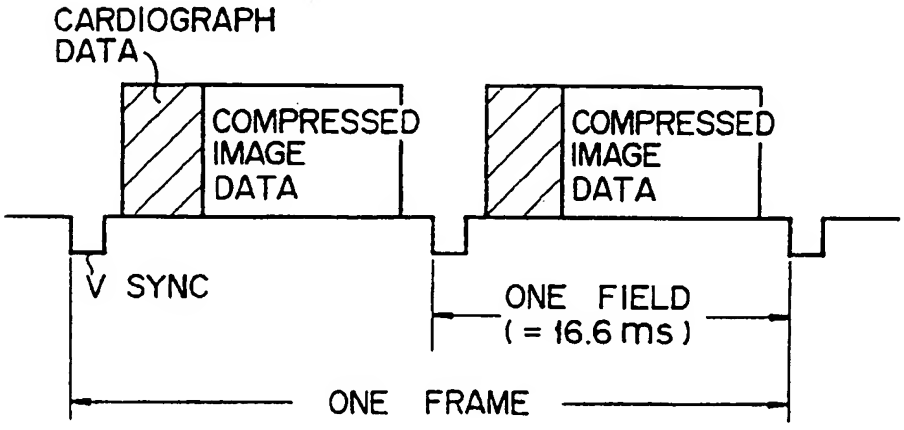

FIG. 5